International Journal of Chemical &
Petrochemical Technology (IJCPT)
ISSN(P): 2277–4807; ISSN(E): 2319–4464
Vol. 12, Issue 1, Jun 2022, 1–6

TRANS STELLAR
•Journal Publications •Research Consultancy

DEVELOPMENT OF NEW TECHNOLOGIES OF SIMPLE SUPERPHOSPHORIC FERTILIZERS BASED ON HUMINS

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ABSTRACT

This article is devoted to the reserves of humic acid in the Republic of Uzbekistan, the physicochemical basis and technology of production, so we will briefly dwell on the main types of simple superphosphate fertilizers containing humin.

KEYWORDS: Humic Acid, Coal & Ordinary Phosphorite

Received: Apr 07, 2022; **Accepted**: Apr 27, 2022; **Published**: May 14, 2022; **Paper Id.**: IJCPTJUN20221

Original Article

INTRODUCTION

At the present stage of economic development of the Republic of Uzbekistan, other CIS countries and the world, one of the important tasks is to improve the quality and quantity of agricultural products. It is one of the key factors in improving the well-being and well-being of the people. One of the main directions for solving the above problem is the development of new technical and technological solutions for the production and use of mineral fertilizers.

In order to study and analyze the priorities in the production and use of mineral fertilizers, this article provides an overview of the state of development in the Republic of Uzbekistan over the past 10-15 years. The most developed industries of mineral fertilizers, including simple and complex fertilizers, fertilizer mixtures and other types of fertilizers are the Russian Federation, the Baltic States and far abroad countries.

Phosphorus is the most important biogenic element necessary for the life of all organisms. Compounds of phosphorus with oxygen (phosphoric acids and phosphates) are the most common in nature and are essential for the existence and development of flora and fauna. It is no coincidence that phosphorus is said to be the key to life.

The range of phosphorus-containing fertilizers is represented by two major groups: simple (unilateral) phosphorus fertilizers, which contain only one nutrient - phosphorus and complex, which in turn divided into two and three (full).

Most phosphates and complex mineral fertilizers are various salts of phosphoric acid, as well as technical products obtained by mechanical grinding or heat treatment of natural phosphates. The technological processes of their production are genetically related to the production of phosphoric acid, phosphorus (V) oxide and elemental phosphorus, as they rely on the same natural phosphate raw material and have similar technological and instrumental bases. As part of a complex fertilizer, not only nitrogen, phosphorus and potassium-containing

minerals (e.g. NPK fertilizers) but also humic acids are used to properly feed the plants in the soil. Organic matter is also needed.

MATERIALS

Humic acids are darkened organic substances obtained from natural products (peat, brown stone, coal, etc.) with aqueous solutions of alkalis. When neutralized in alkaline solutions, humic acids precipitate in the form of amorphous precipitates. In nature, humic acids are formed from plant residues or as a result of oxidation of mined coal and other organic products. Dead plant remains that fall into the soil or swamp during the peat phase of coal formation serve as a nutrient medium for the growth of various microorganisms; the product of their vital activity is humic acids. Another way in which humic acids are formed in nature is the oxidation processes that occur when oxygen dissolved in the atmosphere or water is exposed to coal or other organic matter. Peat and brown humic acids differ from humic acids formed during the oxidation of coal by the ratio of carbon to hydrogen (less than 15 in the former and more in the latter).

The literature is devoted to a detailed review of some types of phosphorus fertilizers, as well as the physicochemical basis and technology of their production, so we will briefly dwell on the main types of simple superphosphate fertilizers containing humin.

In the presence of humic acids, the absorption of phosphorus by plants is improved due to the formation of more soluble forms of phosphates. Therefore, the addition of a certain amount of organic matter containing humic acids is one of the promising ways to increase the efficiency of the use of mineral fertilizers. The organization of industrial production of humic drugs requires large stocks of cheap raw materials of constant quality. Such raw material can be ordinary brown coal, the significant reserves of which are accumulated in the Angren, Shargun, Boysun regions of the Republic of Uzbekistan.

METHODS

Humic acids are prone to oxidative hydrolytic and tautomeric changes, have high oxidation-reduction potential, and form complexes with metals of varying valence. The most important feature of humic acids, which opens the possibility of mobilization of indigestible forms of phosphorus, is their acidity. This is due to the presence of carboxyl and phenolic groups in the acidic properties of natural compounds. The use of complex phosphorus fertilizers containing humic substances not only increases the resistance of the soil to adverse agrogenic factors, but also helps to enrich the plants with nutrients. Much work has been done to study the process of obtaining organomineral fertilizers based on phosphate and humus raw materials, including brown coal. Thus, the study of technological aspects of joint processing of phosphate and humic raw materials presented in the study showed a positive effect of humic components on the decomposition process of natural nitrogen phosphates of natural and anthropogenic origin. The rate of conversion of phosphorus into digestible forms can be increased by 35% due to the addition of an organic component.

The technology of obtaining phosphorus organo-mineral fertilizers, including mechanical processing of coal and phosphate in planetary mills, has been developed (Figure 1).

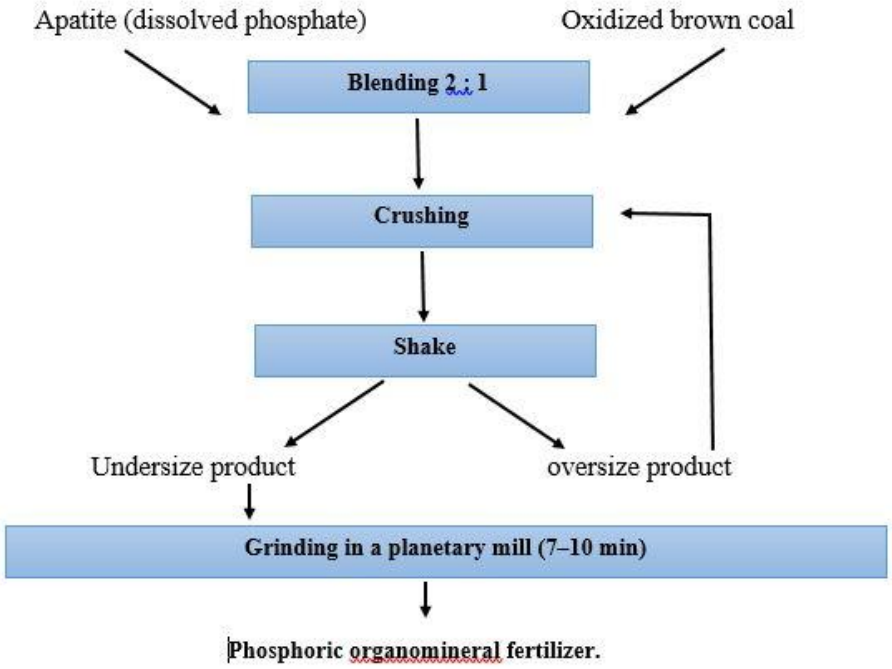

Figure 1: Technological Scheme of Obtaining Phosphorous Organo Mineral Fertilizers from Phosphate and Oxidized Brown Coal.

Mechanochemical activation of a mixture of ordinary phosphorite flour (or crushed fraction) from Central Kyzylkum phosphorites with oxidized brown coal allows to obtain phosphorous organomineral fertilizers with high assimilation of P2O5 and humic acids.

RESULTS

In this case, the final product contains 5% soluble phosphorus and the yield of humic acids in the dry ashless substance is 9.5%. According to scientists, the technology has a much higher economic efficiency due to the use of cheap natural raw materials, unloaded capacity of concentrators located near the mines (crushers, mills). As a result of the research, a method of obtaining organomineral fertilizers was proposed, which consisted of mixing pre-ground phosphates and brown coals to 0.1 to 0.3 mm.

The amount of brown coal included in this fertilizer is 70-98% of its mass. However, fulvoic acids, which are present in brown coals and are chelating agents, react with calcium ions of phosphates, resulting in an increase in their solubility and digestibility by plants.

The methods known in the literature for obtaining humic acids from solid fuels, including brown coal, can be divided into two groups. Some are based on the precipitation of free humic acids by the formation of soluble salts of humic acids under the action of aqueous solutions of alkali or alkaline salts, followed by acidification of the alkaline solution with mineral acid. Other methods are based on the use of organic solvents: aqueous solutions of aqueous dioxane, acetyl bromide, furfural, hexamethylenetetramine, and urea. However, there is no single organic solvent that can select humic acids without affecting other organic substances in the fuel. Therefore, the use of alkaline reagents has become widespread in practice.

Disadvantages of the method include a significant overload of the obtained organomineral fertilizer with brown coal. In addition, the grinding of phosphates and brown coal is carried out separately, which requires the use of additional grinding aggregates. Based on the analysis of the literature on the preparation of fertilizer mixtures, the working scientists identified a method of production of phosphorous organic mineral fertilizers, the essence of which is the mixing of phosphorous raw materials with organic additives and mixtures. Oxidized brown coal in the ratio of 1.0: 2.0: 1.0-1.5 and technical hydrolytic lignin are used as additives. The use of this oxidized brown coal mixture with lignin allows to increase the amount of P2O5 soluble in lemon. Disadvantages of the method include that the organic additive in the fertilizer (a mixture of oxidized brown coal and lignin) is 3-3.5 times more phosphates. This is 75-80% of the mass of fertilizer formed. It should be noted that too frequent use of technical hydrolytic lignin in organomineral fertilizers can lead to unwanted side effects due to high acidity and the presence of toxic low molecular weight phenolic compounds in the lignin. Based on the established physicochemical laws of interaction of components forming phosphorite particles with humic compounds in the process of acid decomposition, complete decomposition of phosphates occurs with low consumption of acid reagent in the presence of humic compounds. The set of researches on development of physicochemical bases of processing of brown coal and phosphorites in fertilizers in the presence of alkali metals allowed to determine acidity processes at activation of brown coal. hydrolysis and oxidative-hydrolytic destruction continue.

The composition and properties of humic compounds depend on the nature of the alkaline reagent, and their output is shown to vary in sequence: NH4OH <KOH <NaOH.

The presence of sodium humate and its incorporation into the soil cover prevents the retrogradation of assimilated forms of phosphorite by assimilated forms of P2O5 and binds excess calcium ions, and the resulting calcium humates help to increase nutrient content and improve fertilizer properties.

DISCUSSIONS

Thus, a technology has been developed for obtaining humic simple superphosphate by adding oxidized coal to an acidic superphosphate mass prior to ammonization and drying. On the one hand, this made it possible to significantly increase the relative content of assimilable forms of P2O5, on the other hand, to reduce the norms of sulfuric acid for the decomposition of phosphate raw materials. When using humus simple superphosphate in agriculture, the humus content in the soil will certainly increase, the structure and physical and mechanical properties of the soil will improve significantly. Due to the content of all the necessary nutrients in the soil, it is possible to obtain a higher and higher quality crop, the nutritional properties of plants and their resistance to diseases are increased.

CONCLUSIONS

To be applied to the soil with a certain chemical composition, fertilizer mixtures are obtained by mixing two, three or more ready-made assortments of fertilizers that have the properties of their compatibility. This property has a significant effect on caking, hygroscopicity of the fertilizer mixture, creates difficulties in introducing caked fertilizers into the soil, requires the use of various technical vehicles and measures to eliminate caked fertilizers. These activities can be eliminated regionally by applying the developed technologies and creating mini-workshops for their production of about 20 thousand tons of fertilizer mixtures from solid materials.

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